

REMARKS

This Amendment is responsive to the Office Action mailed December 14, 2007. After entry of this Amendment, claims 1, 3, 6-8, 10, and 12-20 are pending in this application and subject to examination. Claims 2, 4, 5, 9, and 11 were cancelled in the Amendment submitted on October 18, 2007. Claim 12 is amended for clarity. Support for this amendment is found in claim 12 as originally filed and at page 7, line 43 to page 8, line 2 in the English-language specification. No new matter has been added.

Applicants thank the Examiner for her professionalism and courtesy during our Telephonic Interview of March 11, 2008.

Reconsideration of the application as amended is respectfully requested in view of the following remarks.

Rejection Under 35 U.S.C. § 112, Second Paragraph

Claim 12 stands rejected under 35 U.S.C. § 112, second paragraph, as indefinite. The Examiner asserts that claim 12 is indefinite because it refers to the oxidizing agent and the starting material as both the higher-boiling reactant and the lower-boiling reactant. *See* page 2, ¶ 4 of the December 14, 2007 Office Action. Applicants respectfully traverse. However, in the interest of expediting prosecution, Applicants have amended claim 12 for clarity. Applicants believe this amendment obviates the indefiniteness rejection and respectfully request its withdrawal.

Rejection Under 35 U.S.C. § 102(b)

Claims 1, 3, 6, 8, 10, 12, 13, 15, 17 and 18 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,957,876 to Rapoport et al. (hereinafter, "Rapoport"). The Examiner asserts that Rapoport teaches each and every limitation of these claims. In particular, the Examiner asserts that the process of Rapoport includes both reaction and separation by distillation. The Examiner asserts that this interpretation of the Rapoport process is supported by

the disclosure of U.S. Patent App. Pub. No. 2004/01622445 to Chen et al. (hereinafter, "Chen"). Applicants respectfully traverse.

Rapoport teaches a process for oxidizing cyclohexane to a product fluid consisting essentially of unreacted cyclohexane, cyclohexanone, cyclohexanol, and cyclohexyl hydroperoxide. *See* column 2, lines 14-17 of Rapoport. The process involves oxidizing cyclohexane in a series of zones wherein cyclohexane is fed downwardly through the zones and an oxidizing gas is passed upwardly through the zones. *See* column 2, lines 19-23 of Rapoport. The tower oxidizer (22) of Figure 1 is disclosed as a suitable apparatus for this process. At the top of tower oxidizer (22), cyclohexane enters through a port (24) and off-gas is removed through a second port (25). The tower oxidizer is divided into 21 zones (1-21) by trays that each contain apertures through which the oxidizing gas passes on its way up the tower. Oxidizing gas may be fed to any or all of the first 18 trays (*See, e.g.*, 26-40). Outlet port (44) is used to continuously remove product from the reactor, while inlet (42) is used to introduce recycled off-gas. *See* Figure 1 and column 4, lines 1-54 of Rapoport. The majority of unconverted cyclohexane is withdrawn at the bottom of the reactor through outlet port (44) together with cyclohexanol and cyclohexanone. *See e.g.*, Example 1 in Table 1 of Rapoport, which demonstrates that of 530 parts by weight of cyclohexane fed to the reactor per hour, only 90 parts by weight per hour of cyclohexane is released in the off-gas. The majority of unreacted cyclohexane is present in the 440 parts by weight of reaction product withdrawn at the reactor bottom.

In contrast, claim 1 recites a process for oxidizing a starting material with an oxidizing agent to obtain a product which comprises:

carrying out the oxidation in a reaction apparatus which has
a bottom region at the lower end,
a top region at the upper end and
a reaction zone between the top region and the bottom region,
maintaining the reaction mixture in the boiling state in the reaction zone, and

introducing oxidizing agent into the reaction zone in at least two substreams;
wherein unconverted starting material leaving the reaction zone is recycled into said reaction zone;
wherein said oxidizing agent is a molecular oxygen-containing gas;
wherein said reaction apparatus is a rectification column; and
wherein a product-containing reaction mixture is withdrawn below the reaction zone.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *See* MPEP § 2131, citing *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Claim 1 requires maintaining the reaction mixture in a boiling state in the reaction zone of the rectification column (*i.e.*, reactive distillation). In contrast, the oxidation process taught in Rapoport is not a reactive distillation. This is supported by the disclosure of Rapoport, which teaches, as noted *supra*, that the majority of **unconverted** cyclohexane in the Rapoport process is **withdrawn at the bottom of the reactor** through outlet port (44) together with cyclohexanol and cyclohexanone. Furthermore, Chen does not support that Examiner's interpretation that the Rapoport process is a reactive distillation. The paragraph of Chen cited by the Examiner merely explains that Rapoport uses a distilling tower reactor to allow cyclohexane feed to flow downwardly and mix effectively with upwardly moving air distributed in different layers. *See* ¶ [0006] of Chen. Thus, since Rapoport fails to either expressly or inherently teach every element of claim 1, Rapoport does not anticipate claim 1. Furthermore, since claims 3, 6, 8, 10, 12, 13, 15, 17 and 18 all depend, either directly or indirectly, from claim 1, which is deemed novel and patentable, these dependent claims are likewise novel and patentable over Rapoport.

Applicants respectfully request withdrawal of this rejection.

Rejection Under 35 U.S.C. § 103(a)

Claims 1, 3, 6-8, 10, and 12-20 stand rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 3,349,007 to Ciborowski et al (hereinafter, "Ciborowski") in view of Rapoport and U.S. Patent No. 5,449,501 to Luebke et al. (hereinafter, "Luebke") and further in view of U.S. Patent No. 2,931,834 to Crouch et al. (hereinafter, "Crouch") and Hawley's Condensed Chemical Dictionary, 12th ed., 1993, p. 1139 (hereinafter, "Lewis"). The Examiner essentially asserts that Ciborowski teaches all of the limitations of claim 1 except for (1) introducing oxidizing agent in at least two substreams and (2) using a rectification column as the reaction apparatus. The Examiner relies on the teachings Rapoport and Luebke to meet these missing features. *See* ¶ 10, pages 4-6 of the December 14, 2007 Office Action. Applicants respectfully traverse.

Applicants incorporate herein in their entirety the above remarks regarding Rapoport.

Ciborowski teaches a distillation process and apparatus for recovery of oxidation product of cyclohexane. The essence of the Ciborowski process lies in compressing vapors of the distilled substance by means of an injector fed by vapors of the same substance and subsequently condensing these vapors in the heating coil of the distilling container. In doing so, Ciborowski teaches that separation of the condensate obtained by liquefaction of the vapors is not necessary, thus making it possible to avoid losses of cyclohexane associated with such separation. *See* column 1, lines 47-56 of Ciborowski.

Luebke teaches a vapor-liquid contacting apparatus useful as a reactor in hydrocarbon conversion reactions, such as catalytic distillation. Figures 1 and 2 of Luebke illustrate that this apparatus has two "catalyst beds," penetrated by a plurality of vertical vapor passageways which provided a means for vapor communication between fractionation sections located above and below that catalyst beds. *See* column 4, line 29 to column 6, line 20 of Luebke.

The Examiner's proposed modification of the process and apparatus of Ciborowski involves substituting the separate reactor and rectifying column of Ciborowski with the reactor

column of Luebke. The Examiner asserts that persons of ordinary skill in the art would be motivated to make this substitution because it would allow for simultaneous performance of the reaction and separation steps. However, the Examiner has not shown how this proposed substitution possesses a reasonable expectation of success, which is required to establish *prima facie* obviousness. See MPEP § 2143.02. For example, the Examiner fails to show how such a modification would not be negatively impact the performance of the Ciborowski process (and that of the Luebke column), particularly since the Luebke reactor column, which already contains two catalyst beds, would have to incorporate both of the coils (See 4 and 5 in the Figure of Ciborowski) that were formerly inside the reactor and rectifying column of the unmodified Ciborowski apparatus. We also note that the Examiner does not explain how this proposed modification of the Ciborowski apparatus, which would entail its substantial redesign and reconstruction, (1) would not render it unsatisfactory for its intended purpose and (2) does not change its principle of operation. See MPEP §§ 2143.01 (V) and (VI).

The Examiner's proposed modification of Ciborowski also involves, based on the teaching of Rapoport, incorporating at least two substreams of oxidizing agent into the Ciborowski process and apparatus. The Examiner asserts that persons of ordinary skill in the art would modify Ciborowski in this manner because addition of oxidizing agent in more than one substream is known and thus within the capability of a person of ordinary skill in the art. The Examiner is essentially asserting that it would have been "well within the capabilities of one of ordinary skill in the art" to modify the teaching of Ciborowski to encompass claim 1. However, such conclusory statements are insufficient to establish *prima facie* obviousness. See *KSR International Co. v. Teleflex Inc.*, No. 04-1350, 2007 U.S. LEXIS 4745, at *37, (April 30, 2007) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"); see also MPEP § 2143.01(IV).

The Examiner has not established that the proposed modification of the Ciborowski process and apparatus according to the teaching of Luebke possesses any reasonable expectation of success. The Examiner has not provided any rationale as to why persons of ordinary skill in

the art would modify the Ciborowski process and apparatus according to the teaching of Rapoport. As such, the Examiner has failed to establish that claim 1 is *prima facie* obvious. Furthermore, since claims 3, 6-8, 10, and 12-20 all depend, either directly or indirectly, from claim 1, which is deemed non-obvious and patentable, these dependent claims are likewise non-obvious and patentable over these combined references.

Applicants respectfully request withdrawal of this rejection.

In view of the foregoing amendment and remarks, Applicants believe the pending application is in condition for allowance.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 12810-00027-US from which the undersigned is authorized to draw.

Dated: March 14, 2008

Respectfully submitted,

Electronic signature: /Eamonn P. Morrison/
Eamonn P. Morrison
Registration No.: 55,841
CONNOLLY BOVE LODGE & HUTZ LLP
1007 North Orange Street
P. O. Box 2207
Wilmington, Delaware 19899-2207
(302) 658-9141
(302) 658-5614 (Fax)
Attorney for Applicant